

February 9, 1995

Mr. Neil Thompson  
U.S. Environmental Protection Agency  
1200 Sixth Avenue  
Seattle, WA 98101

Re: Review of Response to Ecology December 5, 1995, Comments on Draft Aquifer Management, Quality Assurance, Field Sampling, and Computer Simulation

Dear Neil:

The purpose of this letter is to provide through your office formal review comments in the subject documents as requested by Michael Kuntz, Managing Hydrogeologist, Washington Department of Ecology. In a February 2, 1995, telephone conversation with Raymond Wayne (E & E, Idaho Falls, ID), Mike requested that E & E review Spokane County's comment responses and prepare formal comments. The review comments are presented as general comments, which provide an assessment of issues impacting more than one comment response, and response-specific comments.

**Response to Ecology Comments  
Draft Aquifer Management, Quality Assurance,  
Field Sampling, and Computer Simulation**

**Comment  
Number**

**Review Comment**

**General Comments:**

1. The county is representing the ground water model as a management tool and not for compliance purposes. This clarification should simplify Ecology and EPA's position. If the model is not used for compliance, then any previous review and approval of the model should not limit regulatory options on compliance issues. As a management tool, the county is free to use the model but the agencies can require proof of compliance independent of the modeling results.
2. The hydraulic and analytical data presented by the county are inconsistent and not current. Ground water elevation contour maps do not encompass the same portion of the site and represent different time periods. A clearer picture of site conditions would be presented if a standard geographic area were used for reporting data. The current reporting area shown on the figures included in the county's response to comments should extend from the landfill to the Little Spokane River on the west and an equal distance to the east. The current north and south boundaries seem appropriate.

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## Response to Ecology Comments

### Comment Number

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#### General Comments (cont):

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3. Ecology and EPA may want to be cautious about accepting domestic well data into the compliance monitoring data base. Domestic well construction standards may not be acceptable for compliance purposes or permit access for data collection. Domestic well access is subject to scheduling conflicts with well owners. Water level stabilization since the last domestic use of the well must be considered. Sample collection procedures must assure no loss of volatile organics if direct access to the water column in the well is not practical.  
  
Well logs or equivalent information should be provided by the county for all domestic wells used for compliance monitoring purposes. An examination of the well drilling and construction information will document the reliability of the water level and analytical data developed from the domestic wells.

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#### General:

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1. Target drawdowns are an acceptable approach for establishing hydraulic control. The main concern is how the target drawdowns were determined. Model-generated target drawdowns are only as good as the model is representative of site conditions. Unless the model is calibrated for site conditions to the satisfaction of the regulatory agency, the model-generated drawdowns should not be used to demonstrate hydraulic control to the agency.
2. The comment response refers to the introductory discussion on the intended use of the ground water flow model. The introduction states on page two (paragraph two) that the model is not intended for use in compliance monitoring. If the county uses the model as a management tool, with no compliance applications, then the comment has been adequately addressed.
3. The Groundwater Monitoring Plan (GWP) identifies monitoring wells CD-31A, CD-34A, CD-44 (C1, C2, and C3), CD-45 (C1, C2, and C3), and CD-S2 as being within or at the edge of the extraction well capture zones. The comment response states that compliance monitoring wells not identified in the GWP as being within the capture zones are considered to be outside the zones. The response relies on model-generated information in identifying those wells that are outside the capture zones.  
  
Using the model to confirm monitoring well locations relative to the capture zone has compliance implications and is beyond the scope of a management tool as previously discussed. If the model was not properly calibrated to site conditions, the model should not be used to confirm compliance monitoring well locations. Field measurements can be used to identify which wells are outside the capture zone under current conditions.  
  
The Remedial Action Status Report (RASR) for the third quarter of 1994 shows the estimated regional drawdown associated with extraction from the upper aquifer (Figure 2-16). The RASR presents field data that show the capture zone extending to wells beyond those identified in the GWP. Section 2.1.2.1 of the RASR states that extraction rates in the upper aquifer may be increased to meet model-predicted drawdowns. Any increase in extraction rates in the southern extraction system would further expand the capture zone with respect to nearby monitoring wells.
4. Migration of site contaminants in the lower aquifer to the northeast and south (comment response Figure 2) appears to be uncontrolled. What assurances can the county provide that the concentrations will remain below performance standards if migration is uncontrolled? The model-predicted capture zone should not be used to indicate compliance since the county previously stated the model is not for compliance purposes.

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#### General (cont):

4. (cont) The response refers to a previous discussion of the probable mechanisms causing contaminant migration and suggests that local ground water pumping is the likely mechanism. The actual ground water elevation contours shown in comment response Figure 6 are pre-extraction but do not present a ground water flow pattern that explains the migration. If extractions from domestic wells were causing the contaminate to migrate, then the contour lines would reflect flow to the wells consistent with plume development. The county should provide a more detailed explanation for the migration supported by field data.

#### Specific: Aquifer Management Plan

1. The comment response appears acceptable.
2. The information presented in the comment response does not sufficiently address contaminant migration in the lower aquifer east of the landfill. The basis for defining the eastern boundary of the TCA contamination in the lower aquifer is not clear (comment response Figure 1). Few of the monitoring wells east of the landfill were sampled (comment response Figures 2 and 4). Figure 6 of the comment response shows the aquifer ending west of the contaminant plume (Figure 2) and monitoring systems (Figure 4). The contour lines shown on Figure 6 do not support flow to the east in the lower aquifer. It is not clear how contaminants would be drawn to the east due to pumpage from domestic wells, as suggested in the Phase I Engineering Report, if no hydrologic units east of the landfill are sufficiently transmissive for effective extraction.
3. See review of General Comment 3.
4. See review of General Comment 3.
5. See review of General Comment 3.
6. The use of quarterly reports as the primary reporting mechanism appears appropriate. Regional drawdown can provide sufficient information to assess the impact of ground water extraction on local ground water supply. Comparisons of actual operating results to model-predicted results for evaluating system efficiency should be used for management purposes and not to demonstrate compliance.
7. The comment response appears acceptable.
8. The discussion presented in Section 2.2 of the GMP states that compliance monitoring wells CD-45 and CD-48 will function as cross-gradient wells, with the potential to be reclassified as downgradient wells if continued plume migration warrants. The discussion of wells CD-45 and CD-48 in the Aquifer Management Plan (AMP) should be clarified to exclude any interpretation that the wells will be used for these purposes concurrently.
9. The comment has not been fully addressed. As both the comment and comment response point out, limited data are available describing the ground water flow system in the upper aquifer toward the Little Spokane River. Figure 1 in the comment response shows TCA concentrations in domestic well 1073E-1 located at the river to be 61 ppb. This concentration exceeds the highest concentrations shown in the figure for the extraction well systems. The ground water elevation contour lines shown in Figure 6 of the comment response should be extended to the river. A clearer understanding of the flow system from the landfill to the river is needed to interpret the analytical data, but it appears some site contaminants are migrating in the upper aquifer to the west.
10. The comment response appears acceptable.
11. The comment response appears acceptable.
12. The comment response appears acceptable.
13. The comment response appears acceptable.

## Response to Ecology Comments

Comment Number	Review Comment
<b>Specific: Aquifer Management Plan (cont)</b>	
14.	The comment response appears acceptable.
15.	The comment response on the locations of the current data collection locations appears acceptable. Ecology and EPA should be careful not to concur with the county's apparent assessment that no additional wells are needed in the northern portion of the plume. Additional definition of the areal extent of contamination in the upper aquifer may be needed, especially along the northeast and northwest perimeters.
16.	The comment response relies on the accuracy of the model. A calibrated model is a useful management tool to identify target drawdowns for system operation. To demonstrate model calibration for site conditions, information that compares model-simulated drawdowns corresponding to the extraction rates used in system operations to the actual drawdowns should be presented. As an example, model-simulated drawdowns could be compared to the drawdowns shown in Figures 2-16 and 2-23 of the third quarter 1994 RASR and the differences discussed.
17.	The comment response appears acceptable. The predicted stabilization times are based on the model and are subject to Ecology and EPA concerns on model calibration. The stabilization times are identified in the text as being model-generated and seem to be presented for informational not compliance purposes.
18.	The comment response appears acceptable.
19.	The comment response addresses what appears to be a policy issue and is beyond the scope of this review.
20.	The number and location of the wells identified in AMP Figure 7-12 for the upper aquifer do not appear adequate, given the plume boundaries shown in comment response Figure 1. Data locations are especially needed north of Norwood Road along the western boundary of the plume. Wells 1073D-1 and 1073E-1 should be included since they show site contaminants (comment response Figures 1 and 3). The well location shown in AMP Figure 7-13 appears adequate for monitoring the lower aquifer. Additional data locations may have to be identified for both aquifers, depending on the information provided from the locations shown in the figures.
21.	The comment response appears acceptable.
22.	Although the system operator needs guidelines for operation, Ecology and EPA should avoid giving the appearance of endorsing specific operator guidance. The county may choose to use the model results as a standard for operations, but Ecology and EPA may prefer to use field analytic and hydraulic data for assessing compliance.
23.	The comment response is consistent with Consent Decree scope of work. Comment response Figure 1 does not provide sufficient analytical data for the upper aquifer between Big Meadow Road and Woodward Road to determine if the upper aquifer is currently a significant source of contamination to the lower aquifer.
24.	The comment response appears acceptable. Ecology may want to consider providing the county with the requested information to expedite resolution of this issue.
25.	The comment response appears acceptable.
26.	The contamination migration monitoring system incorporates many domestic wells. Well construction information for these wells should be summarized and provided to assure that the data collected from the domestic wells are of comparable quality to the monitoring wells. The domestic wells (shown on comment response Figure 3) that are near the extraction wells should be compared to the actual drawdowns reported in the RASR to determine which wells can be considered downgradient or cross-gradient to the capture zone.
27.	The comment response is consistent with the Consent Decree and appears acceptable.

## Response to Ecology Comments

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#### Specific: Field Sampling Plans:

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- 1 - 3. The comment response for each comment appears acceptable, although decontaminating the pump internals before use does not appear to impose an undue burden on field operations.
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#### Specific: Computer Simulation:

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1. The comment raises issues, which are partially addressed by the response. Although practical considerations exist with any field data collection activity, the representativeness of the data must be the highest priority.  
  
Since the 1990 data set used in model calibration was collected, additional data have become available. If the 1990 data were representative of site conditions and the model was accurately calibrated to the data, the model should be able to simulate the subsequent data-generated ground water elevation contours. A comparison of the model-generated and data-generated contour lines for several field data collection events would help resolve many issues related to model calibration.
2. The comment response indicates that the river bed conductance was varied for the model-generated information to approximate field measurements for other model parameters. This approach is consistent with model calibration practices, but it puts additional emphasis on the data sets used for the other parameters. If the data used for model calibration is not representative of site conditions, the attempt to match the data will result in unrepresentative values being incorporated into the varied parameters. This issue is related to the previous review comment.
3. The comment response does not satisfy the comment. No technical rationale was offered for modeling the upper and lower aquifer, using separate models. The two aquifers are connected as evidenced by the contaminant migration and Lacustrine unit pinch-out to the east. Site geology can be adequately addressed by standard ground water codes such as MODFLOW.
4. The comment response does not satisfy the comment. The discontinuation of the Lacustrine unit could have been addressed by modeling the flow system in one model encompassing both aquifers. No rationale was provided to explain why the eastern boundary of the model domain was not located a greater distance east of the landfill to avoid any possible model boundary effects.
5. The comment response does not satisfy the comment:  
  
Bullet 1: The elevation of Deep Creek above the upper aquifer does not preclude a mounting of the water table in the aquifer beneath the creek bed due to infiltration and percolation of water from the creek.  
  
Bullet 2: If Deep Creek is a perennial stream east of Highway 2, then the potential impact of the creek as a recharge source is greater than if the creek was intermittent.  
  
Bullet 3: Few data locations that identify the flow direction in the upper aquifer near the creek are shown on comment response Figure 5. If water level data show that the creek has no hydraulic influence on the upper aquifer, the creek can be ignored from a modeling perspective.
6. The comment response does not satisfy the comment. Comment response Figure 1 shows TCA concentrations in the upper aquifer along the Little Spokane River in three domestic wells south of the springs. The wells and springs are west of the Lacustrine unit, and the figure suggests that ground water flow in the upper aquifer is not structurally controlled by the unit.

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**Specific: Computer Simulation (cont):**

7. Modeling the western boundary of the upper aquifer as no flow does not appear consistent with the analytical data shown in comment response Figure 1 (see previous review comment).  
  
Editorial: The description of the northern and southern boundaries of the lower aquifer as "perpendicular to flow" should be changed to "parallel to flow." The boundaries are perpendicular to the contour lines and therefore parallel to flow. This is an editorial comment and does not dispute the use of no flow boundary conditions.
8. Figures 5 and 6 presented with the comment response satisfy the comment. There appears to be significant differences in orientation between the model-simulated and field-measured contour lines for the upper aquifer. Specifically, the relative position of the 1772-, 1768-, 1762-, 1760-, and 1758-ft contours for the simulated and field-measured elevations impacts ground water flow direction. The contour for the lower zone (Figure 6) shows considerable agreement between the simulated and field-measured lines. For both figures the area contoured should be extended west to the river and include the area east and northeast of the landfill at least for the field data contours.
9. The capture zone shown on Figures 9 through 12 of the 1993 technical memorandum needs to be compared with the contaminant plume boundaries shown in Figure 2 of this comment response. Figure 2 shows the plume to extend north and south of the capture zones shown in Figures 9 through 12; therefore, it appears contaminant breakthrough will occur.
10. Without addressing dispersion, the extent to which the capture zone extends laterally beyond the contaminant plume is not known. The lack of a dispersion factor in the modeling work increases the importance of the analytical data from wells of known integrity along the margins of the plume.
11. The development of the input parameters is consistent with standard modeling practices. The drawdown matching approach between the (b) (6) well and the model cell containing that well should be clarified. The model will average the drawdown over the area of the cell, while field data represent a discrete point in space. Did the drawdown comparison adjust for the model averaging?

If you have any questions regarding these comments, please do not hesitate to call me at 624-9537.

Sincerely yours,  
ECOLOGY AND ENVIRONMENT, INC.

Lyle Diediker  
Project Manager

cc: Debbie Larson, EPA, Region 10  
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